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मानक

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Mazdoor Kisan Shakti Sangathan

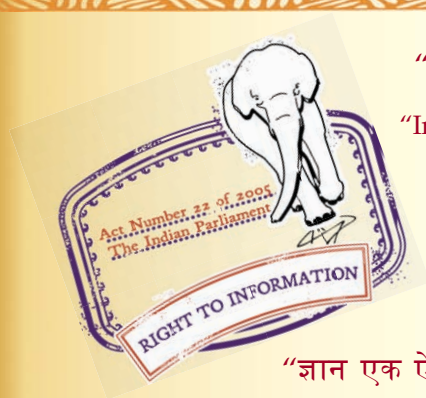
“The Right to Information, The Right to Live”

“पुराने को छोड़ नये के तरफ”

Jawaharlal Nehru

“Step Out From the Old to the New”

IS 1897 (2008): Copper strip for electrical purposes [MTD
8: Copper and Copper Alloys]



“ज्ञान से एक नये भारत का निर्माण”

Satyanarayan Gangaram Pitroda

“Invent a New India Using Knowledge”



“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”

Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”

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भारतीय मानक
विद्युत अनुप्रयोगों के लिए तँबे की पत्ती — विशिष्टि
(तीसरा पुनरीक्षण)

Indian Standard
COPPER STRIP FOR ELECTRICAL PURPOSES —
SPECIFICATION
(*Third Revision*)

ICS 77.150.30

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BUREAU OF INDIAN STANDARDS
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NEW DELHI 110002

FOREWORD

This Indian Standard (Third Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Copper and Copper Alloys Sectional Committee had been approved by the Metallurgical Engineering Division Council.

This standard was first published in 1962 and was subsequently revised in 1971 and 1983. In this revision, the following modifications have been made:

- a) Definition of strip has been modified to 6 mm thick (*see* 3.1),
- b) Reference of cathode copper have been deleted (*see* 6),
- c) Edgewise bending test have been made optional (*see* 8.3),
- d) Mechanical properties Table 1 have been modified (*see* 8.1),
- e) Temperature correction factor in electrical resistivity has been added as a Note (*see* Table 3),
- f) Alternate method for electrical conductivity test included (*see* 9.1.1), and
- g) Straightness value of 3 mm per 1 000 mm length has been added (*see* 11.3).

Copper strips are used for electrical connections and windings, for transformers and related electrical machinery. Bright annealed copper strips are used for non-insulated connections. Half hard copper strips are required to be used when the finished products, such as bus-bars and connections elements in heavy switchgear constructions call for a certain amount of stiffness and rigidity and at the same time are subject to some degree of cold work.

The composition of the Committee responsible for the formulation of this standard is given in Annex A.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

COPPER STRIP FOR ELECTRICAL PURPOSES — SPECIFICATION

(Third Revision)

1 SCOPE

This standard specifies the requirements of copper strip for electrical purposes with drawn or rolled edges (either round or square) in the annealed, half-hard and hard condition.

2 REFERENCES

The following standards contain provisions which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

<i>IS No.</i>	<i>Title</i>
191 : 2007	Copper (<i>fourth revision</i>)
440 : 1964	Methods of chemical analysis of copper
613 : 2000	Copper rods and bars for electrical purposes — Specification (<i>third revision</i>)
1387 : 1993	General requirements for the supply of metallurgical materials (<i>second revision</i>)
1501 : 2002	Method for Vickers hardness test for metallic materials (<i>third revision</i>)
1599 : 1985	Method for bend test (<i>second revision</i>)
1608 : 2005	Metallic materials — Tensile testing at ambient temperature (<i>third revision</i>)
3052 : 1986	Dimensions and tolerances for wrought copper and copper alloys sheet, strip and foil (for general engineering purposes) (<i>second revision</i>)
3288	Glossary of terms relating to copper and copper alloys :
(Part 1) : 1986	Materials (<i>third revision</i>)
(Part 3) : 1986	Wrought forms

IS No.

Title

3635 : 1966	Methods of test for resistance of metallic electrical resistance material
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3 TERMINOLOGY

For the purpose of this standard, the definition given in IS 3288 (Parts 1 and 3) and the following shall apply.

3.1 Strip — Flat product over 0.15 mm thick and upto and including 6 mm thick, of any width and generally not cut to length; usually in coil, but may be flat or folded.

4 SUPPLY OF MATERIAL

The general requirements relating to the supply of material shall conform to IS 1387.

5 CONDITION OF SUPPLY

The material shall be supplied in one of the following conditions, as specified by the purchase:

- a) O — Annealed (Soft),
- b) HB — Half-hard, and
- c) HD — Hard.

6 CHEMICAL COMPOSITION

The materials when analysed as per IS 440 or any other established instrumental (spectrometer)/ chemical method shall conform to the requirements of Grade Cu-ETP or Cu-FRHC as per IS 191. In case of dispute, the procedure given in IS 440 shall be the referee method. However, when the method is not given in IS 440 the referee method shall be as agreed to between the purchaser and the manufacturer.

7 FREEDOM FROM DEFECTS

The material shall be clean, bright, smooth and free from harmful defects. Strips not supplied in coils shall be reasonably flat and free from twists.

8 MECHANICAL PROPERTIES

8.1 The material when tested in accordance with IS 1608 and IS 1501 shall have the mechanical properties as given in Table 1.

Table 1 Mechanical Properties of Strip
(Clause 8.1)

SI No.	Temper	Thickness mm		Tensile Strength MPa		Elongation Percent on 5.65 $\sqrt{S_0}$ or 50 mm Gauge Length, Min	Hardness HV
		Over	Up to and Including	Min	Max		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	O	0.15	1.8	205	250	30	60, Max
		1.8	6.0	205	250	35	60, Max
ii)	HB	0.15	1.8	245	—	10	75-90
		1.8	6.0	245	—	15	75-90
iii)	HD	0.15	6.0	290	—	—	90, Min

NOTES
1 The material which has undergone further process of insulation and covering, the hardness values in annealed condition shall increase to an extent to 10 percent maximum of the values specified in the Table.
2 1 MPa = 0.102 kgf/mm².

8.2 Bend Test

The material is to be tested for bend test in accordance with IS 1599 . The test piece shall not fracture or crack on the convex surface of the bend portion, when bent once through the angle and bend radius as specified in Table 2.

8.3 Edgewise Bending

8.3.1 When agreed to between the purchaser and the manufacturer, annealed strip with more than 12 mm width, tested at full width, shall be capable of being bent on edge through 180° around a former of radius equal to half of the width of the strip without cracking.

8.3.2 For annealed strip of width up to 12 mm the radius of bend shall be as agreed to between the purchaser and the supplier.

NOTE — For annealed strip below and upto 1 mm thick, the edgewise bending test shall not be applicable.

9 ELECTRICAL RESISTIVITY TEST

9.1 The standard value at 20°C for the electrical resistivity of annealed high conductivity copper shall be taken as 0.017 24 ohm mm²/m. The electrical resistivity of the strip shall be measured in accordance with IS 3635. The electrical resistivity values are given in Table 3.

9.1.1 The method of measurement employing eddy current probe shall be applied for electrical conductivity test subject to mutual agreement between the purchaser and the supplier.

10 TEST FOR CONTROLLED PROOF RESISTANCE (OPTIONAL)

10.1 This test is to be conducted only when it is asked by the purchaser.

10.2 For the purpose of the electrical resistance per unit length in material supplied to a controlled range 0.1 percent proof stress the material shall be deemed to be in the hard or half-hard condition. The values

Table 2 Bend Test
(Clause 8.2)

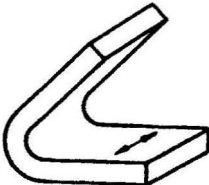
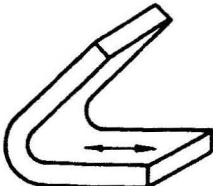
Thickness	Condition	Transverse Bend Test		Longitudinal Bend Test	
Up to and Including 6 mm	O HB HD				
		Angle	Radius	Angle	Radius
		180°	Close	180°	Close
		180°	Close	180°	Close
		90°	Close	90°	Close

Table 3 Electrical Resistivity and Conductivity
(Clause 9.1)

SI No.	Condition	Resistivity Ohm mm ² /m at 20°C Max	Conductivity (IACS) Percent Min
(1)	(2)	(3)	(4)
i)	O	0.017 37	99.25
ii)	HB and HD	0.017 77	97.00

NOTES

1 Conductivity percent is expressed as percentage of the standard value for standard annealed copper of 100 percent conductivity as laid down by IACS.

2 When tested at temperature other than specified above, the temperature correction factor as given in Annex B of IS 613 shall be applied.

of 0.1 percent proof stress of three different controlled range of proof stress up to 6 mm thick strip are given in Table 4.

11 DIMENSIONS AND TOLERANCES

11.1 The strip shall be supplied in dimensions specified in IS 3052 subject to the tolerance specified in the same standard.

11.2 The strip shall have corners or edges either radiused or square. In the former case, the radius of curvature shall be in accordance with Table 5, unless

otherwise stated.

11.3 Straightness

The tolerances on straightness and/or edgewise curvature shall not vary from a straight line by more than 3 mm in any 1 000 mm length.

12 SAMPLING AND CRITERIA FOR CONFORMITY

12.1 Unless otherwise agreed to between the purchaser and the manufacturer, the following

Table 4 Controlled Proof Stress Copper Strip
(Clause 10.2)

SI No.	Designation	Thickness		0.1 Percent Proof Stress MPa
		Over mm	Up to and Including mm	
(1)	(2)	(3)	(4)	(5)
i)	CPR1	0.80	6.0	140-200
ii)	CPR2	0.80 1.20	1.20 6.0	170-230 170-220
iii)	CPR3	0.80	6.0	220-260

Table 5 Radius on Edges or Corner of Strip
(Clause 11.2)

All dimensions in millimetres.

SI No.	Thickness of Strip		Nominal Radius on Edges	Tolerance
	Over	Up to and Including		
(1)	(2)	(3)	(4)	(5)
i)	—	1.0	Semicircular	± 0.06
ii)	1.0	1.6	0.6	+ 0.15 - 0.10
iii)	1.6	2.25	0.8	± 0.15
iv)	2.25	3.55	1.0	± 0.20
v)	3.55	—	1.25	± 0.25

sampling procedure and criteria for conformity shall apply.

12.2 Lot

In a consignment the copper strips of the same width and thickness, and of the same temper shall be grouped together to form a lot not exceeding 2 000 kg. One or more lots may be formed from the material submitted for inspection depending on the weight. Each lot shall be separately sampled for acceptance purposes.

12.3 Visual and Dimensional Requirements

The material shall be individually examined for freedom from defects and dimensional tolerance. At least one sample or coil from each bundle shall be selected for dimensional inspection. No failure shall occur if the lot is to be accepted under this clause.

12.4 Chemical Composition and Mechanical Properties Requirements

From each lot, one sample at the rate of 2 000 kg or part thereof for chemical test and one sample at the rate of 500 kg or part thereof shall be tested for mechanical properties requirements of this standard. The sample shall be cut-off cold and shall receive no further treatment (except that they may be machined to the shape of the test piece) before being tested. The lot shall be accepted under this clause if the samples tested meet all the chemical composition and mechanical properties requirements of the specification.

12.5 Electrical Resistivity Test

For this test at least one sample for each bundle or from 500 kg or single coil weight, whichever is higher shall be taken from different boxes or crates or bundles as the case may be and shall be individually subjected to electrical resistivity test. The samples shall meet the requirements if the lot is to be accepted under this clause.

13 RETEST

13.1 If a test result of chemical analysis fails to satisfy the requirements for any element, two more

tests for that element, shall be done on the sample in order to confirm that the analysis has been done properly. If both the test results satisfy relevant requirements, the lot shall be considered conforming to the specification, otherwise no

13.2 Should any one of the test pieces first selected fail to pass the mechanical tests, two further samples from the same batch shall be selected for testing, one of which shall be from the strip from which the original test sample was taken, unless that strip has been withdrawn by the supplier.

13.2.1 Should the test pieces from both additional samples pass, the batch represented by the test sample shall be deemed to comply with the standard. Should the test pieces from either of the additional samples fail, the batch represented by the test sample shall be deemed not to comply with the standard.

14 PACKING

The strip shall be packed in bundles, boxes, or crates so as to ensure safe transportation of the material.

15 MARKING

15.1 Each package shall be marked with the grade and temper of the material, name of the manufacturer, the mass, size, lot number, date of manufacture, and any other information required by the purchaser.

15.2 BIS Certification Marking

The material may also be marked with the Standard Mark.

15.2.1 The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act, 1986* and the Rules and Regulations thereunder. The details of the conditions under which the licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

ANNEX A

(Foreword)

COMMITTEE COMPOSITION

Copper and Copper Alloys Sectional Committee, MTD 8

<i>Organization</i>	<i>Representative(s)</i>
Indian Copper Development Centre, Kolkata	DR D. DE SARKAR (<i>Chairman</i>)
Agarwal Metal Works Pvt Ltd, Rewari	SHRI D. K. JAIN SHRI O. P. RANA (<i>Alternate</i>)
Alcobex Metals Ltd, Jodhpur	SHRI G. C. KANUNGO SHRI S. D. PUROHIT (<i>Alternate</i>)
Bhabha Atomic Research Centre, Mumbai	SHRI V. K. TANGRI SHRI S. K. GUPTA (<i>Alternate</i>)
Bharat Electronics Ltd, Bangalore/Ghaziabad	SHRI SRIDHAR S. NADIGER SHRI ANUJ SINGH (<i>Alternate</i>)
Bharat Heavy Electricals Ltd, Bhopal	REPRESENTATIVE
Birla Copper Ltd, Bharuch	DR P. R. LANDGE SHRI B. M. SHARMA (<i>Alternate</i>)
Crompton Greaves Ltd, Mumbai	SHRI T. P. GOVINDAN
Chandra Protoco Ltd, Silvasa	SHRI A. CHAKRAVORTHY DR S. K. ROY (<i>Alternate</i>)
DGS&D (Quality Assurance Wing), Kolkata/New Delhi	SHRI B. DAS GUPTA SHRI S. K. PANDEY (<i>Alternate</i>)
Finolex Cable Ltd, Bangalore	REPRESENTATIVE
Gem Sanitary Appliances P Ltd, Delhi	SHRI B. K. SINGHAL SHRI V. K. CHOWDHARY (<i>Alternate</i>)
Hindustan Copper Ltd, Kolkata	SHRI A. K. SARKAR SHRI J. BHATTACHARJEE (<i>Alternate</i>)
Indoswe Engineers Pvt Ltd, Pune	SHRI U. K. JATIA SHRI S. K. JAIN (<i>Alternate</i>)
International Copper Promotion Council (India), Mumbai	SHRI AJIT ADVANI SHRI MILIND RAJE (<i>Alternate</i>)
Larsen & Toubro Ltd, Mumbai	REPRESENTATIVE
Ministry of Defence (DGQA), Katni	QAO, QAE (MET) SHRI P. K. SAHAJWANI (<i>Alternate</i>)
Ministry of Defence (OFB), Kolkata	SHRI R. K. VARSHNEY SHRI P. S. BANDHOPADHYAY (<i>Alternate</i>)
Ministry of Defence (DMRL), Hyderabad	DR S. NAGARJUNA
Ministry of Railways (RDSO), Lucknow	SHRI A. K. MANDAL SHRI S. K. DAS (<i>Alternate</i>)
Rupam Conductors (P) Ltd, Mumbai	SHRI HASMUKH R. MEHTA SHRI S. R. RAJYAGOR (<i>Alternate</i>)
Machine Tool Prototype Factory, Ambernath	DR A. S. BALGI
Rapsari Engineering Industries Ltd, Bangalore	DR P. SRIRAM SHRI K. U. B. PRAVEEN (<i>Alternate</i>)
Saru Copper Alloy Semis Pvt Ltd, Meerut	SHRI D. P. JAIN SHRI SANJEEV JAIN (<i>Alternate</i>)

<i>Organization</i>	<i>Representative(s)</i>
Sterlite Industries India Ltd, Silvassa	MS MEENAKSHI SABHARWAL SHRI SURESH SIDWALKAR (<i>Alternate</i>)
The Indian Smelting & Refining Co, Mumbai	SHRI D. BHATTACHARYYA SHRI M. P. SAHLOT (<i>Alternate I</i>) SHRI V. D. KELUSKAR (<i>Alternate II</i>)
Vanaz Engineers Pvt Ltd, Pune	REPRESENTATIVE
BIS Directorate General	DR (SHRIMATI) SNEH BHATLA, Scientist 'F' & Head (MTD) [Representing Director General (<i>Ex-officio</i>)]
<i>Member Secretary</i>	
SHRI DEEPAK JAIN	
Scientist 'E' (MTD), BIS	

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Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Catalogue' and 'Standards: Monthly Additions'.

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Amendments Issued Since Publication

Amendment No.	Date of Issue	Text Affected

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